

Amendments to the Claims

This listing of claims will replace all prior versions and listings of claims in the application:

Listing of Claims:

Claims 1 – 19 (Cancelled)

Claim 20 (Previously Presented): The method of claim 30, further comprising:

- a) cooling said parts in a vessel, wherein said vessel comprises a gas stirring system; and
- b) adjusting the composition of said mixture to obtain an average density of said mixture which is capable of being stirred by said stirring system, without having to make significant changes to said vessel.

Claim 21 (Previously Presented): The method of claim 30, further comprising adjusting the composition of said mixture so that endothermic chemical reactions can occur between said absorbing gas and at least one other component of said mixture.

Claim 22 (Previously Presented): The method of claim 30, wherein said absorbing gas comprises CO₂.

Claim 23 (Cancelled)

Claim 24 (Previously Presented): The method of claim 30, wherein the content of said absorbing gas in said mixture is between about 5% to about 100% of the total mixture volume.

Claim 25 (Previously Presented): The method of claim 24, wherein said content is between about 20% to about 80%.

Claim 26 (Previously Presented): The method of claim 30, wherein said gas mixture comprises a binary CO₂/He mixture, wherein the CO₂ content of said mixture is between about 30% to about 80% of the total mixture volume.

Claim 27 (Previously Presented): The method of claim 30, wherein said gas mixture comprises a binary CO₂/H₂ mixture, wherein the CO₂ content of said mixture is between about 30% to about 80% of the total mixture volume.

Claim 28 (Previously Presented): The method of claim 30, further comprising recycling said mixture wherein said recycling comprises:

- a) recompressing said mixture prior to a subsequent use; and
- b) processing said mixture to recover at least one component of said mixture, wherein said processing comprises at least one process selected from the group consisting of:
 - 1) separating; and
 - 2) purifying.

Claim 29 (Cancelled)

Claim 30 (CURRENTLY AMENDED) A method for rapidly cooling metal parts using a pressurized cooling gas mixture comprising the step of contacting the metal parts with the pressurized cooling gas mixture at a pressure of 4 to 20 bars, wherein:

the cooling gas mixture consists essentially of

- a) one or a plurality of infrared radiation absorbing gases selected from the group consisting of saturated hydrocarbons, unsaturated hydrocarbons, CO₂, CO, H₂O, NH₃, NO, N₂O, NO₂ and mixtures thereof and

b) ~~optionally~~ an additive gas that comprises at least one member selected from the group consisting of helium, hydrogen and mixtures thereof;

the composition of said mixture is adjusted to obtain an average mixture density that is approximately the same as that of nitrogen;

the composition of said mixture is adjusted ~~adjusting the composition of said mixture~~ to optimize said mixture's convective heat transfer coefficient, as compared to the individual convective heat transfer coefficients of each component of said mixture; and

the mixture has convective heat transfer properties superior to those of nitrogen in similar cooling conditions.

Claim 31 (CURRENTLY AMENDED): A method for rapidly cooling metal parts using a pressurized cooling gas mixture comprising the step of contacting the metal parts with the pressurized cooling gas mixture at a pressure of 4 to 20 bars, wherein:

the cooling gas mixture consists essentially of a) a content of from about 5% to about 80% by volume of one or a plurality of infrared radiation absorbing gases selected from the group consisting of saturated hydrocarbons, unsaturated hydrocarbons, CO₂, CO, H₂O, NH₃, NO, N₂O, NO₂ and mixtures thereof and b) ~~optionally~~ an additive gas that comprises at least one member selected from the group consisting of helium, hydrogen and mixtures thereof in order to improve the heat transfer to the part by combining radiative and convective heat transfer phenomena and to improve the convective heat transfer coefficient in comparison with conventional conditions of cooling under nitrogen;

adjusting the composition of said mixture to optimize said mixture's convective heat transfer coefficient, as compared to the individual convective heat transfer coefficients of each component of said mixture; and

the cooling gas further comprising an additive gas having a good convective heat transfer capability and selected from helium, hydrogen and mixtures thereof;

the composition of said cooling gas mixture being adjusted to obtain an average mixture density that is approximately the same as that of nitrogen.

Claim 32 (Previously Presented): The method of claim 30, wherein said gas mixture comprises a binary mixture selected from a binary CO₂/He mixture and a binary CO₂/H₂ mixture, wherein the CO₂ content of each of these mixtures is between about 20% to about 80% of the total mixture volume.

Claim 33 (NEW) A process of forming a pressurized gas mixture suitable for cooling a metal part, the process comprising the steps of

- a) providing one or a plurality of infrared radiation absorbing gases selected from the group consisting of saturated hydrocarbons, unsaturated hydrocarbons, CO₂, CO, H₂O, NH₃, NO, N₂O, NO₂ and mixtures thereof,
- b) forming a gas mixture comprising the infrared radiation absorbing gases,
- c) adjusting the composition of said mixture to
 - 1) optimize said mixture's convective heat transfer coefficient, as compared to the individual convective heat transfer coefficients of each component of said mixture,
 - 2) obtain an average mixture density that is approximately the same as that of nitrogen, and
 - 3) obtain a mixture having convective heat transfer properties superior to those of nitrogen gas in similar cooling conditions.

Claim 34 (NEW) The process of claim 33 further comprising the step of adding a gas that comprises at least one member selected from the group consisting of helium, hydrogen and mixtures thereof.